Catalogue No. 7

ALBERGER COOLING TOWERS

ALBERGER CONDENSER COMPANY

NEW YORK CHICAGO

VIEW OF FOUNDRY AND MACHINE SHOPS

ALBERGER
COOLING TOWERS

BAROMETRIC CONDENSERS SURFACE CONDENSERS

JET CONDENSERS VACUUM PUMPS

CORLISS CIRCULATING PUMPS

CENTRIFUGAL AND TURBINE PUMPS

HIGH VACUUM SYSTEMS FOR STEAM TURBINES

WAINWRIGHT FEED-WATER HEATERS

EXPANSION JOINTS AIR COOLERS

ALBERGER CONDENSER COMPANY

95 LIBERTY STREET

NEW YORK

BRANCH OFFICE

HOME INSURANCE BUILDING

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Note

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THIS COMPANY IS PREPARED TO MAKE SURVEYS OF PLANTS AND TO FURNISH PLANS, DRAWINGS, SPECIFICATIONS AND ESTIMATES, AND TO CONTRACT FOR COOLING TOWERS, HEATERS, EXPANSION JOINTS AND CONDENSING APPARATUS FOR ALL KINDS OF SERVICE

TERMS—NET CASH WITH EXCHANGE ON NEW YORK

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Patents

THE MANY NEW FEATURES OF THE APPARATUS AND OF THE METHODS HEREIN DESCRIBED AND ILLUSTRATED ARE THOROUGHLY COVERED BY LETTERS PATENT, ISSUED AND PENDING, IN THIS AND FOREIGN COUNTRIES

Alberger Cooling Towers

APPLICATION AND ADVANTAGES OF COOLING TOWERS

Cooling Towers were commercially introduced into this country about fifteen years ago. Since that time they have been installed in a great variety of situations and have become recognized as an important and valuable adjunct to power stations and refrigerating plants, where the water supply is limited.

That the experimental stage has been passed is evidenced by the fact that numerous steam plants have been located where there is no natural water supply for condensing purposes and have been equipped with condensing engines and cooling towers. This selection of site has been influenced by better coaling facilities, more favorable distribution of the electric current, the lesser cost of land away from water fronts, and the knowledge that results practically equal to those obtainable with a natural water supply can be had with properly applied cooling towers. It may at first seem unreasonable to imply that the same results can be obtained, but it must be borne in mind that cooling towers possess operative advantages of considerable importance. When they are used the water supply to the condensers is not liable to be cut off by ice or other foreign material, nor the suction lost on account of low water, as is not infrequently the case where rivers subject to considerable rise and fall are the source of the condensing water. The presence of a supply of water in the cooling tower, at practically the ground level, allows the condensing apparatus to carry large over-loads without loss of the suction. The fixed suction lift thus obtained assures the delivery of a constant quantity of water to the condenser without the use of complicated speed-governing devices which are neces-

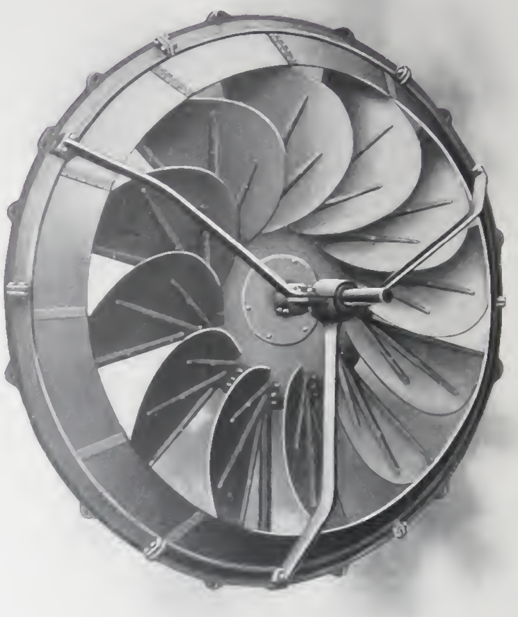
ALBERGER COOLING TOWER

sary when a varying suction lift exists, as is the case where the condensing water is taken from a source subject to rise and fall due to tide or climatic conditions. Freedom from foreign material permits of the use of a more complete spraying device in the condenser, and a higher efficiency follows; furthermore, the durability of the condenser is enhanced as the water usually contains the oil from the cylinder lubrication of the main engines and is free from any material that can wear the moving parts. The use of Cooling Towers also relieves the condenser and pumps from corrosive action caused by the presence of salt and some chemicals often found in natural water supplies.

It is these and other seemingly small points that when grouped together have proved very valuable to the every day running of a steam plant. There is nothing so objectionable as the loss of vacuum through the stoppage of the water supply. Even if the station can carry the load with the engines running non-condensing, they will be at a great disadvantage and will usually show harshness of action, which may result in a serious disarrangement. A single occurence of this kind more than offsets any slight difference of steam economy by the use of Cooling Towers instead of a natural water supply.

Description of the Alberger Cooling Tower

The Alberger Cooling Tower is cylindrical in form and is constructed of sheet steel, carefully riveted and braced. It is a substantial apparatus and a fitting adjunct to a Mill or Power Station. There are two types, one in which the air is circulated by means of one or more fans, and the other by means of a stack placed over the Cooling Tower proper, which produces a draft when the air becomes heated by the hot water from the condenser. The former type is especially suited for ammonia condenser work and for steam condensers where the space available is limited, or where the Tower can be placed to advantage upon



VIEW OF FAN SHOWING ARRANGEMENT OF BLADES

VIEW IN TOP OF TOWER SHOWING DISTRIBUTOR

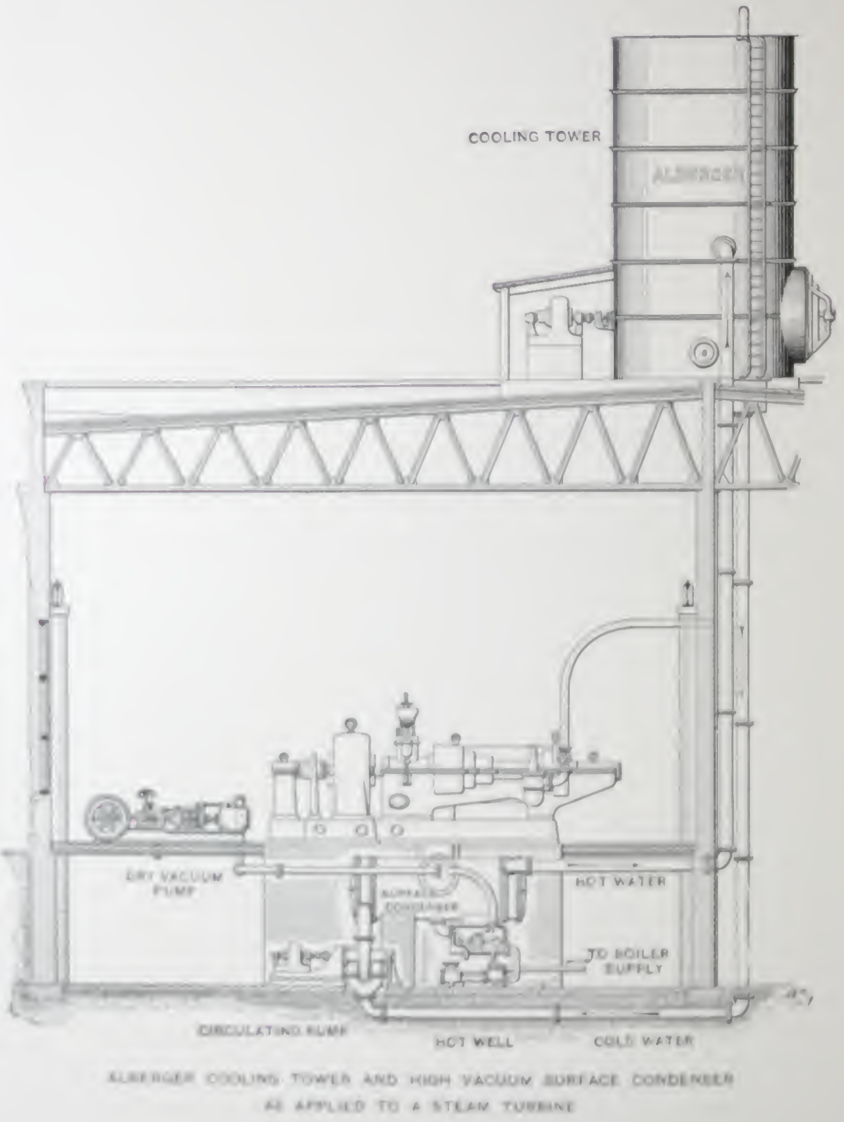
the roof of the engine or boiler house. While, of course, the power required to operate the fan is a constant charge, still by running the fan at a reduced speed, when the load is light or the weather is cold, and by returning the heat of the exhaust steam from the fan engine to the boiler by way of the feed water, the actual charge is reduced to an inconsiderable amount.

The filling of the Alberger Cooling Tower consists of boards of swamp cypress, geometrically arranged in a regular manner so as to positively determine a complete and ultimate distribution of the water and the air, there being no haphazard arrangement of the filling or changeable condition that may divert the air and the water in any one particular direction. This kind and arrangement of filling recommends itself because of the uniform effectiveness of the sheets of water exposed to the air on its extended surface. When tile or metal tubing are packed in layers, the spaces between the adjacent pieces are very much smaller than those through the center of the tubes, although there is about the same amount of surface enclosed between the points of contact. This reduced space restricts and prevents the passage of a full amount of air and consequently the effectiveness of the surface is much impaired. As one layer is stacked upon the other, it is very common to find the intersticial space entirely blocked off by the thick walls of tile in the next layer, and in this way rendered absolutely inactive. Cloth and wire mats have been used, but dirt and lubricating oil from the cylinders of the main engines is very apt to find a lodging place in the small spaces between the strands that form the meshes and compel the water to travel in more or less heavy streams down the face of the mats without useful contact with the air. Such constructions require frequent cleaning to maintain their original capacity for doing work. The arrangement of the filling in the Alberger Cooling Tower is such as to not only render every square foot of its superficial area effective as cooling surface, but also insures the exposure to the air of a very large additional amount of surface due to the thin sheets of water falling from

ALBERGER COOLING TOWERS SUPPLY THE WATER FOR THE CONDENSER OF A 2000 K. W. STEAM TURBINE

the lower edge of one course of filling to the top edge of the second course below it. The additional surface of water thus presented to the cooling action of the air makes the effective cooling surface nearly double the actual surface of the filling. The careful geometrical arrangement of the filling is such as to offer the least possible frictional resistance to the circulation of air, thus reducing the power required to operate the fans to a minimum, and at the same time permits the passage of an extra large volume of air when required, as in the case of a temporary over-load. The filling used in the Alberger Cooling Tower is cut from the heart of the true swamp cypress, and is, as is well known, most durable and practically imperishable under the conditions of saturation that exist. The United States Government Circular No. 19, Department of Agriculture, Division of Forestry, cites cases in which, in Philadelphia and Baltimore, cypress shingles have endured for a period of over eighty years, and examples illustrating the wonderful durability of this wood exist in the cities of Mobile and New Orleans, where roofs laid with cypress shingles over sixty years ago are in good order. The controlling idea in the design of this Tower is to circulate the least possible amount of air and, by repeated and determinate sub-divisions of the current, to bring it into contact with a large surface of water and thus utilize its cooling power to the greatest extent.

The distributor is shown in perspective upon page 8. It will be seen that the water issues from the arms of the distributor through tubes so arranged as to cause the water to retain its jet form until it reaches the filling, upon which it adheres and spreads. As each tube has to supply water for all the filling over which it passes during a revolution, it is of necessity of comparatively large diameter and does not become clogged with leaves or other similar material, as happens with the small holes or slits found in some stationary distributors that rely upon the fineness of the jets to break up and spray the water. The hub of the distributor, which carries the arms, is rotated upon a roller



ALBERGER COOLING TOWER AND HIGH VACUUM SURFACE CONDENSER AS APPLIED TO A STEAM TURBINE

bearing by the re-action of the jets of water, and the small amount of resistance offered permits of a steady and constant rotation with a very low velocity of water at the spouts. This insures smooth, unbroken jets and eliminates any chance of the water being blown out of the top of the Tower in an unevaporated state and thus lost. An even and practically perfect distribution of water over the filling of the Tower is assured, and it is not possible for any portion of the filling to receive more than its proportion of water while other parts receive less and are perhaps dry.

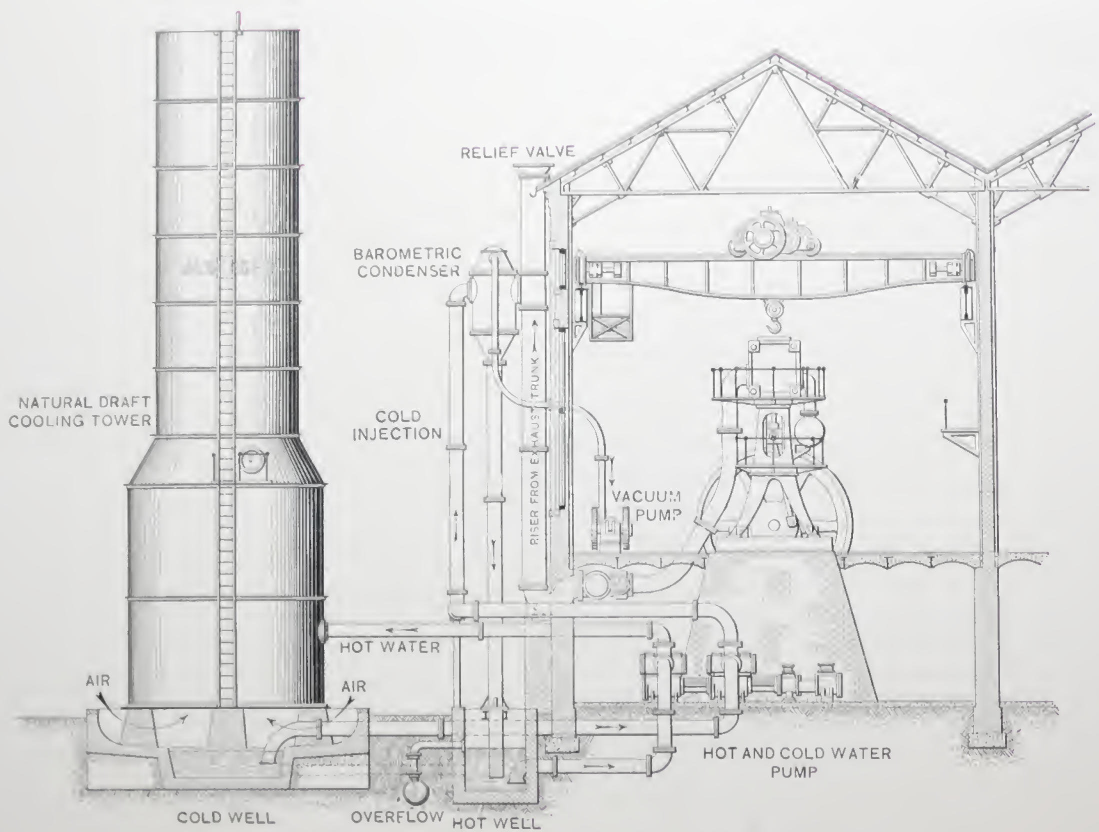
The fans used to circulate the air in the fan towers are the product of long experience and give high efficiency under the exacting conditions of Cooling Tower work. They are extremely well built and are adapted for continuous and long service. The cut on page 8 illustrates the method of attachment of the blades to the steel hub, and also the substantial construction of the surrounding parts. The bearings are of the ring oiling type fed from a reservoir and require attention only at long intervals. These fans are specially designed to eliminate all possibility of "back lash" or return air currents between the fan blades and the casing, and in this way the accumulation of ice in the casing during cold weather and serious damage to the fan resulting therefrom is entirely avoided. The peculiar conical form of the outside casing or frame of this fan makes use of the centrifugal force of the air as it is thrown from the ends of the blades, thus combining the more positive operating principles of a pressure blower with the great volume capacity of the disc type of fan.

The cut on the opposite page shows a Cooling Tower upon the roof of the engine room, the fan being operated by an electric motor, directly connected to an extension of the shaft. This cut shows the application of the Alberger High Vacuum Condensing Apparatus to a steam turbine. The water is circulated through a surface condenser, and up to the tower by an electrically driven centrifugal pump. (A steam driven pump may of course be substituted, if desired). The work done by this pump,

ALBERGER COOLING TOWERS
COMBINATION FAN AND NATURAL DRAFT TOWERS

however, is only that due to the height of the Cooling Tower, because the descending column of water balances the ascending column, with the exception of that distance. Carrying out this idea still further, the Cooling Tower can be placed at any height above the condenser, if such a location is desirable for other reasons, without materially increasing the load upon the pump.

The surface condenser is shown as operating on the Alberger Dry Vacuum System which is particularly adapted to the production of the extremely high vacuum so desirable in connection with steam turbines. In this system, the air is removed by a special dry vacuum pump of the type shown on page 27; the vacuum cylinder of this pump has small clearance spaces and the inlet and discharge valves are particularly adapted for the handling of air and vapor without the use of water in the cylinder. The condensed steam is removed from the condenser by means of a hot well pump automatically controlled so as to prevent any accumulation of water. This pump being required to handle water only and being placed beneath its supply has very light work to perform, compared with one handling a mixture of water, air and vapor. The circulating pump is preferably an independent unit, and can be operated in proportion to the work. The water and steam are directed through the condenser in such a manner that the air before leaving the condenser comes in contact with the coldest tubes, and is reduced in volume and to a temperature approximating that of the cold condensing water. The condensed steam in the form of water is removed after contact with the hottest tubes. With a condensing equipment of this type, it is possible to maintain an extremely high range of vacuum without a natural water supply, and furthermore, as no oil is used in turbines, an ideal feed water, free from scale, oil and air, is obtained.



THE ALBERGER NATURAL DRAFT COOLING TOWER AND BAROMETRIC CONDENSER

The Alberger Natural Draft Cooling Towers

The Alberger Natural Draft Cooling Tower represents the most advanced type, as no power is required to circulate the air. This Tower is preferably about eighty feet high, and consequently should be placed on the ground level. It is an excellent machine to use when it is desirable to convey the vapor from the Tower above adjoining buildings, or where the Tower must be at some distance from the engine room, and such a location renders inconvenient the transmission of power to the fan of a fan tower. In the Alberger Natural Draft Cooling Tower the arrangement of filling employed is the same as that already described, except that it is placed at the extreme bottom of the Tower, and air is allowed to enter around the piers that support the structure. The distributor is the same as that used with the fan towers, and the stack is connected to the top of the Tower by means of a conical section, as illustrated on the opposite page.

The condensing apparatus shown is the Alberger Barometric Condenser, and is especially suited to large engines, or to stations containing a number of engines, all of which may be exhausted into it. The distinctive features of this type of condenser are described and illustrated in another circular, which will be furnished upon application.

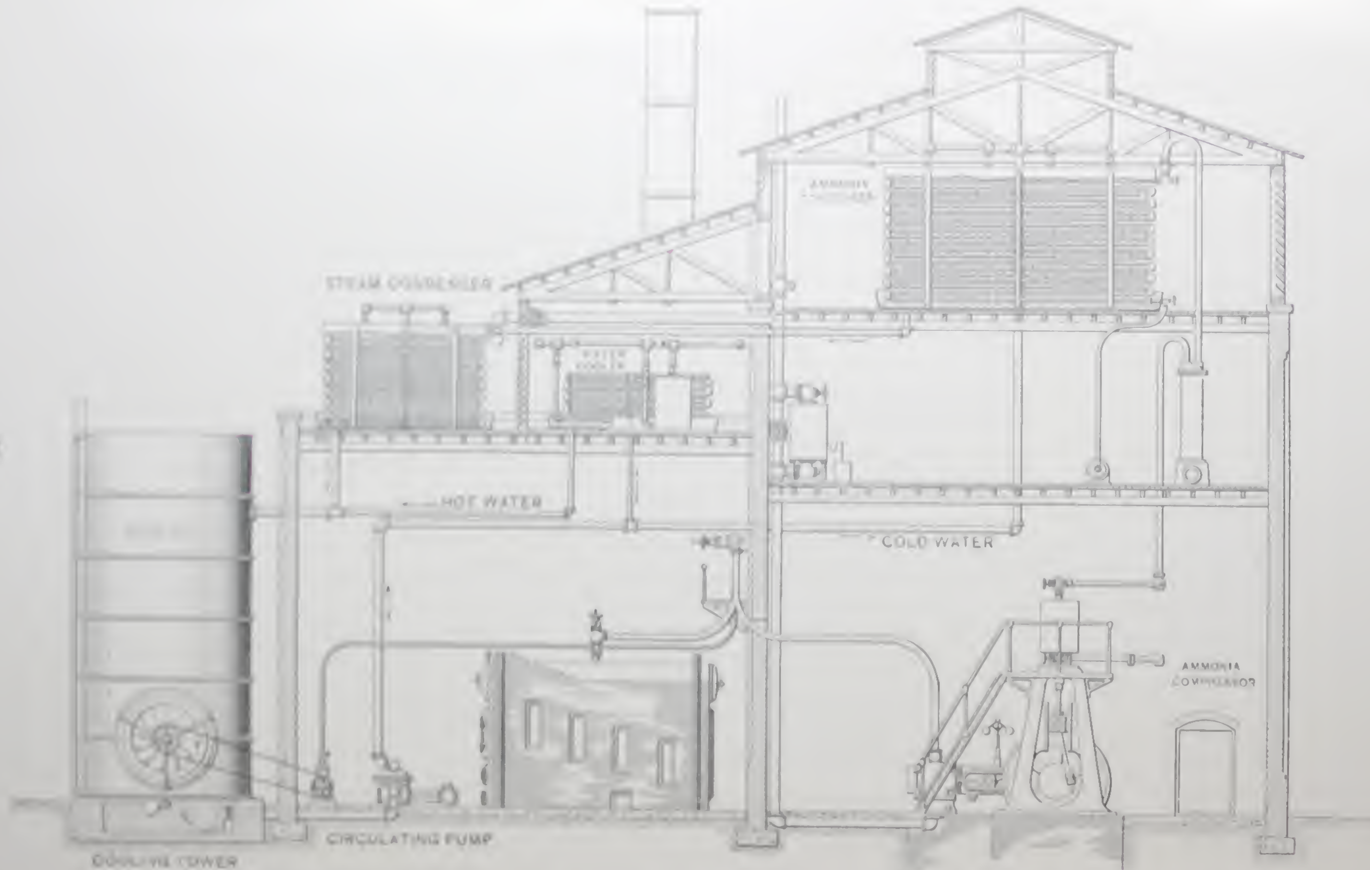
It will be seen that the circulating pump comprises hot and cold water pumps, operated by the same steam end. Centrifugal pumps, either steam or electrically driven, are well suited for this service. The cold water pump derives its supply of water from the cold well of the Cooling Tower and discharges into the Barometric Condenser, being assisted by the vacuum in the latter. The water there condenses the exhaust steam from the engines and falls down the tail pipe against the atmospheric pressure to the hot well; from the latter it is removed by the hot water pump and discharged to the distributor of the Tower.

ALBERGER NATURAL DRAFT COOLING TOWER

After falling through the Cooling Tower and becoming cooled by the evaporation caused by contact with the ascending air, it finally reaches the cold well, cooled for re-use in the condenser. In this Tower and in the Fan Tower, when used in connection with steam condensers, the water produced by the condensation of the exhaust steam is sufficient to compensate for the evaporation in the Tower, and none need be supplied to the system. There is, on the contrary, a slight overflow which carries with it the oil from the engine cylinders, and in this manner constantly cleans the system of oil that would otherwise accumulate in the hot well. There are no places in the Cooling Tower which form hiding places for the oil, and the constant overflow maintains a uniformly operative condition of the entire apparatus.

The Alberger Cooling Towers for Refrigerating Plants

There are several hundred refrigerating plants, cold storage houses and ice manufacturing companies that save by the use of Cooling Towers about 90% of the water used to cool the ammonia condensers in their factories. If city water has been employed for this purpose the saving in money is often very considerable, and it is safe to say that in all cases a very handsome profit on the investment is assured. Cooling Towers have been substituted with excellent results for natural water supplies where the same has carried large quantities of mineral matter or contained corrosive material. Sea water is very objectionable for use in ammonia condensers, as it necessitates the replacing of the coils at frequent intervals. It has repeatedly been shown to be good practice to use Cooling Towers and pay for the 10% of city water that will be required to make up for the loss by evaporation, rather than to buy and install new condenser coils and pipes every year or so.



ALBERGER COOLING TOWER AS USED WITH AMMONIA AND STEAM CONDENSERS IN AN ICE MANUFACTURING PLANT

The cut opposite illustrates an Alberger Cooling Tower as applied to an ice manufacturing plant; such a plant differs from an ordinary refrigerating plant as used by breweries and cold storage houses, in that a steam condenser and a water cooler are an additional portion of the apparatus. By tracing the course of the water it will be seen that there is no complication in this device. The cold water is taken by the circulating pump and discharged over the ammonia condenser; after becoming partially heated, it then passes over the steam condenser and falls into the Cooling Tower where it is cooled for re-use. When a water-cooler is employed, a portion of the cold water is allowed to pass over the water-cooler while in its coolest condition.

It has been found that properly constructed Cooling Towers will cool the water during the summer months to an average temperature quite below the ordinary temperature of city water or running streams.

There is one point in regard to the application of a Cooling Tower in connection with ammonia condensers that is not thoroughly understood by those who have not given the matter more than a passing consideration. As the circulating water, after passing over the condenser, immediately returns to the Tower, it is evident that during a given time any amount of water up to the capacity of the circulating pump can be passed over the condenser. There is practically an unlimited supply available and there is no necessity of trying to cut down the water to the lowest possible amount, as is the case when it has to be pumped from a deep well or paid for when taken from the city supply. It will be found, therefore, that by circulating an ample amount of water, the temperature of the ammonia condenser can be lowered with a corresponding reduction of ammonia pressure and power demanded of the compressor.

Alberger Cooling Towers

With Condensers of Steam Turbines

Reference has been made on previous pages to the use of Cooling Towers in connection with Condensers of steam engines, but it is undoubtedly in the application to steam turbines that this apparatus reaches its fullest utility. This arises from the fact that a vacuum is of greater relative value to a turbine than to a reciprocating engine. The saving in steam consumption by condensation frequently exceeds fifty per cent. This is such an important consideration that only in exceptional cases can large turbines be profitably run non-condensing.

Many plants of this kind with Alberger Cooling Towers and Condensers are running with highly satisfactory results. Non-condensing reciprocating engines in several installations are being exhausted into low pressure steam turbines and the vacuum maintained by High Vacuum Condensers supplied with water from Alberger Cooling Towers. In these latter cases, the net output of the turbines, after deducting the fixed charges and the cost of operation of the Towers and Condensers, shows this latest feat of engineering to be remarkably profitable.

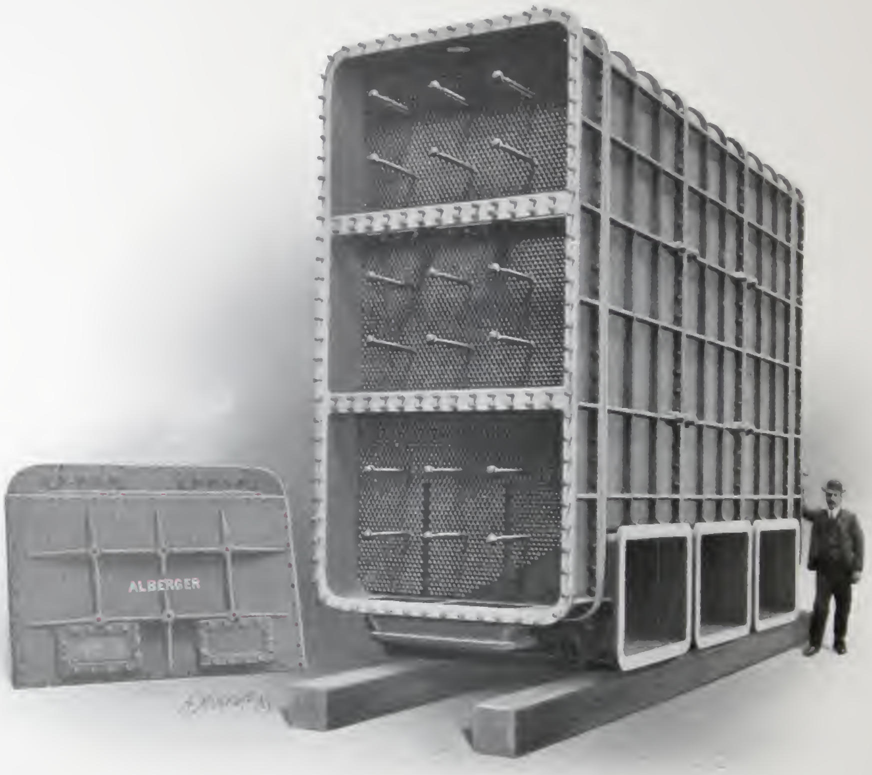
As every quarter of an inch of vacuum in the high ranges means several per cent in the steam consumption of a turbine, it is obvious that the type and efficiency of the condensing equipment requires careful consideration. When working with Cooling Towers the temperature differences and contrasts are so exceedingly small that it is vital to the full accomplishment of the result that apparatus of the highest character be employed. The Alberger High Vacuum apparatus as now offered is the outcome of a large and varied experience in this line of work.

The Alberger Barometric Condenser

ALBERGER BAROMETRIC CONDENSER

SECTIONAL VIEW

The Alberger Barometric Condenser is used extensively with steam engines, steam turbines and with vacuum pans and evaporators. It produces condensation in a very complete and efficient manner, and with great safety of operation. It operates upon the dry vacuum principle, the water being delivered to the condenser by a circulating pump and the air removed after condensation by means of a dry vacuum pump. It is adapted to the largest installations and is used in steel and cement mills and other manufacturing plants as a central condenser receiving the exhaust steam from several engines. A fully descriptive and illustrated catalogue will be sent upon application.



ALBERGER COUNTER-CURRENT SURFACE CONDENSER
USED WITH 6000 K. W. STEAM TURBINES

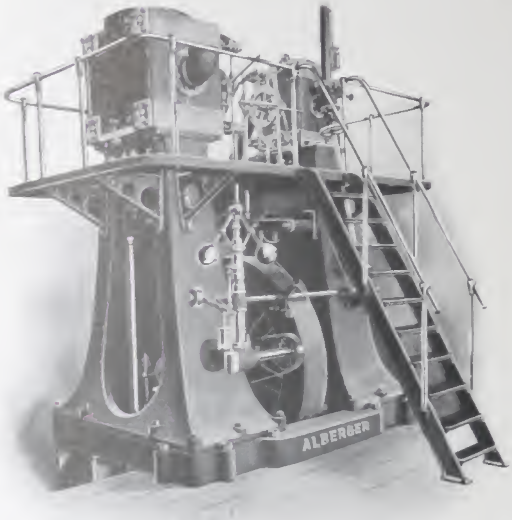
The Alberger Surface Condenser

ALBERGER COUNTER-CURRENT SURFACE CONDENSER

This condenser has several very unique features. The exhaust steam enters either at the bottom, as shown on the above cut, or at the side near the bottom. The cooling water enters at the top and leaves at the bottom. The object of this arrangement is to obtain a full counter-current transfer of heat. The steam as it rises is condensed and the water thus produced falls down against the incoming steam and is removed by a hot-well pump. On account of this intimate contact the feed-water acquires the same temperature as the steam. The air left after condensation, before being withdrawn by the dry vacuum pump, is cooled by passing over the tubes containing the coldest circulating water.

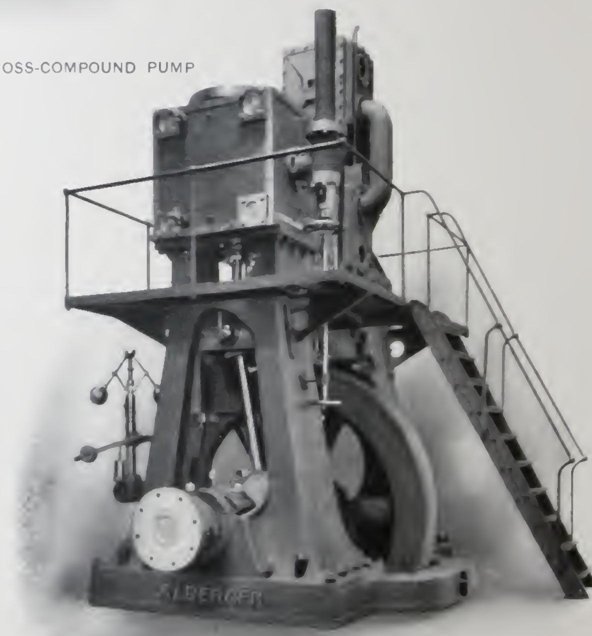
This condenser is capable of producing the most complete condensation and the highest ranges of vacuum. It is especially suited for use with steam turbines as the condensation of the latter depends upon very small differences of temperature and the most complete and efficient transfer of heat is of great importance.

The Alberger Corliss Pumping Engines



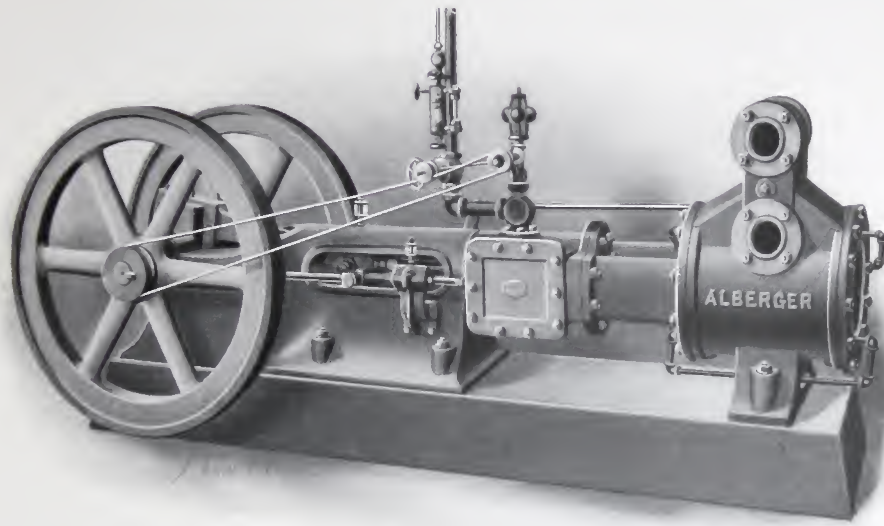
ALBERGER CORLISS VERTICAL CROSS-COMPOUND PUMP

In large installations of condensing apparatus, where the quantity of water to be pumped is very considerable, it becomes a matter of economy to employ circulating pumps of the highest grade. This is especially so when the location is such that the water has to be pumped to a considerable elevation, or is subject to great fluctuations in level of supply. The upper illustration on this page shows one of sixteen vertical cross-compound pumping engines built for this purpose. The lower cut is of a combined vacuum and circulating pump used in connection with an Alberger Central Condenser, which receives the exhaust steam from engines aggregating 20,000 horse-power.



ALBERGER CORLISS VACUUM AND CIRCULATING PUMP FOR CENTRAL CONDENSER

The Alberger Dry Vacuum Pumps



ALBERGER ROTATIVE DRY VACUUM PUMP

The above illustration shows the Alberger Rotative Dry Vacuum Pump in its simplest form. It is the effectiveness of this pump that has made the dry vacuum system of condensation so desirable. It is intended to pump air alone and it does so with the greatest efficiency and is used not only with barometric and surface condensers, but also with the condensers of vacuum pans, glycerine stills and the like.

For the highest ranges of vacuum the vacuum cylinders are compounded, one cylinder discharging into the other after the manner of a two-stage air compressor. These pumps are built in sizes to meet all requirements from 100 to 20,000 horse-power and above. The larger machines are provided with Corliss steam cylinders and valve motions.

A special catalogue descriptive of these pumps and their application may be had free upon request.

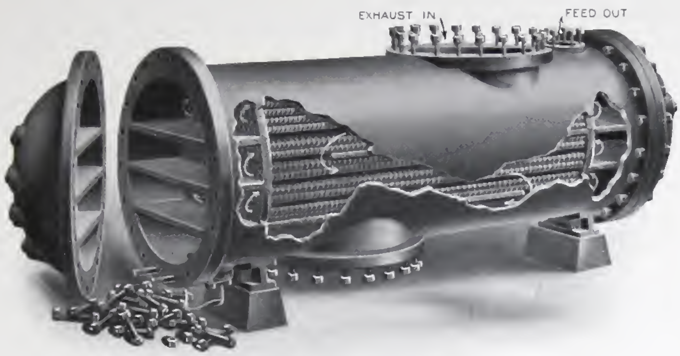
The Wainwright Evenflow Heaters

Corrugated Tube

It is a well-established principle of steam engineering that a fuel saving of about one per cent. is made by each increase of ten degrees in the temperature of the boiler feed-water. Furthermore, it is conceded that a great saving in the wear and tear of steam boilers is effected by heating the water before introducing it to the hot surfaces. Hence every effort is now made to utilize for this purpose the waste heat of the power plant.

WAINWRIGHT HEATER—VERTICAL PATTERN

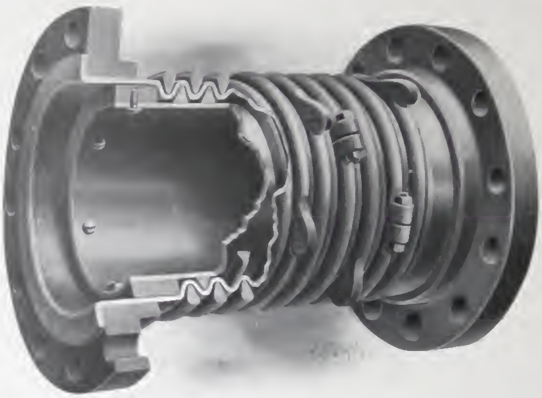
Wainwright Heaters in various forms have been on the market for several years and have met with steadily growing success. This has been due to the care given to their manufacture and also to the more extended appreciation of their merits by engineers and other users. In them was first demonstrated in a practical manner the value and efficiency of the corrugated tube, the importance of relatively high velocities and the advantages of counter-currents, and a great deal has been learned about the best ways and means for applying these principles.



WAINWRIGHT HEATER—HORIZONTAL PATTERN

The Wainwright Evenflow Heater of the horizontal pattern is illustrated above in a most desirable form—that is to say, the evenflow principle is applied not only to the flow of water through the tubes but to the flow of steam through the shell, and this application is by no means confined to the horizontal form of heater but it may be applied with equal success to the heater in a vertical position. It is only necessary that the shell shall be of sufficient diameter to make the introduction of the shell partitions practicable from the foundryman's point of view. In every Wainwright Heater the flow of the water is directed by partitions through different groups of tubes, but in heaters having shells of small diameters, no attempt is made to divert the course of the steam from its direct passage through the shell once, from one end to the other. In the sizes which permit of the use of reasonably large diameters in the shell, advantage is taken of the opportunity to direct the flow of the steam by means of shell partitions so that it shall pass three times the length ot the shell in making its journey from the exhaust inlet to the exhaust outlet opening. Under these circumstances the full benefit of the valuable counter-current effect is obtained.

The Wainwright Improved Expansion Joints



WAINWRIGHT IMPROVED EXPANSION JOINT

The increasing use of superheated and high-pressure steam, and the resulting thickness and rigidity of the piping and fittings to convey it, make expansion joints a desirable and even necessary part of an installation. The objections to stuffing boxes and long sweeps are well known and fully appreciated by those who have been induced to employ them. The Wainwright Improved Expansion Joints have many features to commend them. They are compact, being no larger than the diameter of the flanges of the pipe in which they are inserted; entirely free from leakage, and so made that they can be readily covered with a non-conducting material to prevent radiation of heat. When properly placed and used they are without question the most satisfactory expansion joints now upon the market.

The Wainwright Improved Expansion Joint for high pressures consists of a main corrugated tube of soft copper, an inner cylindrical slip tube of hard copper or composition, external and internal equalizing rings of cast-iron, and connecting flanges of cast-iron or steel. The function of the corrugated tube is

obvious. It withstands the internal pressure and makes an absolutely tight connection from one end to the other. The equalizing rings are used to limit the movement of the corrugated tube in any one convolution and to cause all of the latter to assume their part of the travel. In this manner not only is a very effective result obtained, but the durability of the device is assured.

The Wainwright Turbine Expansion Joints

This expansion joint is especially suited for piping which conveys exhaust steam either to the atmosphere or to condensing apparatus. It has found its greatest use in the connecting piping between steam turbines and condensers. It serves not only to relieve the turbine from strains due to imperfectly supported weight of the condenser and piping, but also from any stresses due to change of temperature or vibration. As a matter of fact, it may form the only connection between the steam turbine and the condenser, and its importance is appreciated when it is considered that the former machine contains steam of very high temperature and pressure and the latter steam of the lowest obtainable temperature and pressure.

It is admirably suited to connect the various cylinders of compound or triple expansion engines and relieves them from the dangerous strains that may occur between massive and closely connected rigid parts. As it is no larger in diameter than ordinary pipe flanges it is readily accommodated to almost any situation.

They are *not intended* for long lengths of piping, unless the piping is anchored at intervals and the movement divided among several expansion joints.

The Alberger Centrifugal Pumps

ALBERGER CENTRIFUGAL CIRCULATING PUMP
ELECTRICALLY DRIVEN

Alberger Centrifugal Pumps are being used very largely for the circulation of water in condensers and for the supply of factories and manufacturing establishments. They are built for a great variety of services and may be driven by steam engines, electric motors, steam turbines, or by belting, as found desirable. New methods of control make possible their use under widely varying conditions of running. Their application to barometric condensers will be found fully described in the catalogue devoted to the subject of Alberger Barometric Condensers, which will be sent free upon request.

ALBERGER CENTRIFUGAL CIRCULATING PUMP
ENGINE DRIVEN

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